RTS Series Down-Hole Pressure Gauge User Manual

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Table of Contents

1. Overview 2

1.1 Main Features 2

1.2 Applications 2

2. Classification and Specifications 3

2.1 RTS Class A (Memory read out) pressure gauge specifications 4

2.2 Ordering information 4

2.3 RTS class B (Surface read out) pressure gauge specifications 5

2.4 Ordering information 5

3. Installation and Operating Instructions 6

3.1 Assembly and configure the gauge 6

3.2 After removal of the gauge 10

3.3 Upload the samples 11

3.4 Plot and analyze the data 12

3.5 Servicing of the gauge 14

4. Troubleshooting 15

1. Overview

RubyTek System Corp. is one of the leading and professional developers that focus on down-hole data acquisition, collection and communications, record and monitoring for oil & gas applications. We offer down-hole gauges that pressure ranges from 3000psi to 20000psi and the temperature ranges from 125℃ to 200℃, with extreme high job upload speed that is less than 4 minutes per million counts (million data points). Our commitment is to provide the excellent instrument and services for the oil & gas industrials in extreme harsh environment.

This manual gives a brief guideline on how to select, use and maintain a RubyTek's RTS series down-hole gauge.

1.1 Main Features

- Long battery life and Large memory capacity
- Single cell AA size or C size battery operation
- Pressure trigger
- Sour service operation
- Data separation for multiple jobs
- Cable connection & Surface readout for real-time applications
- Software for on-site configuration and data analysis support with Win2000/XP/Vista

1.2 Applications

- Well Testing
- Monitor Well Performance
- Permanent Sensors (Monitoring)
- Completion Diagnostics
- Well Stimulation
- Reservoir Characterization
- Gradient Surveys

2. Classification and Specifications

The product lines can be classified as **class A** (MRO, memory read out) and **class B** (SRO, surface read out) according to the data recording type (memory storing or real-time transferring), and each class is further classified according to their operating environment (pressure and temperature ranges), sensor type (Quartz or Silicon-Sapphire) and data communication interface (USB or RS232).

The **class A** down-hole pressure gauge is designed with battery power and target for portable applications. The advantages to compare with traditional products are:

1) Higher data transfer speed for job upload (12Mbps);
2) User GUI tool for data plot and data comparison/analysis
3) No extra download box or USB/RS232 converter needed;
4) Battery monitor and life evaluate;
5) System clock & flexible job schedule settings (system clock, sampling interval, job start/end time), configuration can be done after the gauge power on;
6) Auto-Log-File function for configuration or operation tracking, no paper works to write down start and stop date on-site;
7) Backward compatible with RS232 COM port is available with extra download box or USB/RS232 converter.

The **class B** down-hole pressure gauge is designed with cable power (+12V DC) and target for real time data collecting or monitoring. The gauge can monitor and transmit the pressure and temperature data up to surface in real time. Both communication and power is one conductor. It is capable of connecting eight gauges in one conductor. The advantages are:

1) Real-time data acquisition and monitoring;
2) No battery life limit and no memory capacity limit, one-time installation and suitable for permanent applications;
3) Bi-directional communications in single cable enable control and re-configuration can be done on-site after the gauge installed;
4) Multiple gauges (up to 8 devices) can be connected and shared in one cable conductor with a bit-rate 800bps, flexible connection for network applications;
5) The communication distance (well depth) can reach up to 4.5 miles or 7.2 km.

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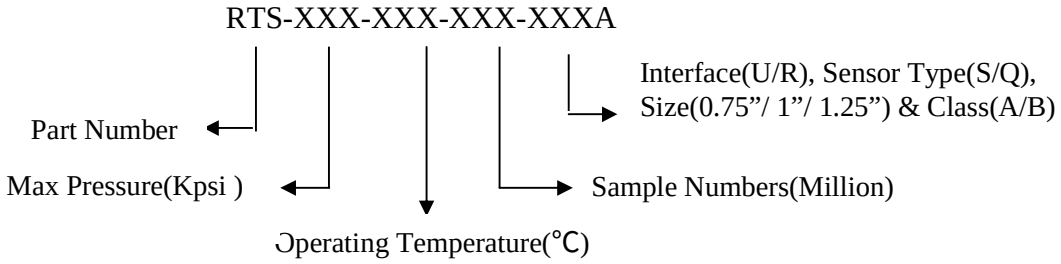
2.1 RTS Class A (Memory read out) pressure gauge specifications

Sensor Type	Silicon-Sapphire	
Pressure	Range:	Up to 20000 PSI
	Accuracy	0.03%(FS)
	Resolution	0.0003%
	Over capacity	110%(FS)
	Drift	3psi/year
Temperature	Atmosphere (Operating Temperature)	150℃ (Max)
		175℃ (Max)
		185℃ - 200℃ (Max)
	Accuracy	0.5℃
	Resolution	0.01℃
	Over capacity	105%(FS)
Data	Sample numbers (Data Points)	0.5 million
		1 million
		2 million
	Data format	Time/Pressure/Temp/Date
Sample rate	1 second to 6 hours (configurable, set on surface)	
Working mode	MRO (Memory read out)	
Power	Single AA or C lithium battery pack	
Battery	Battery voltage monitoring feature	
Communications	Interface	USB, RS232
	Bit rate (upload job)	12Mbps, 230Kbps
User Interface	Friendly user GUI software for gauge configuration, job upload and data view/plot/analysis, run on PC with Window2000/XP/Vista.	
Size	Outside diameter	0.75”, 1”, 1.25”
	Length	10 – 12”
Environment	H_2S	
Housing material	Inconel718-NACE, SS17-4 PH	

2.2 Ordering information



Example:

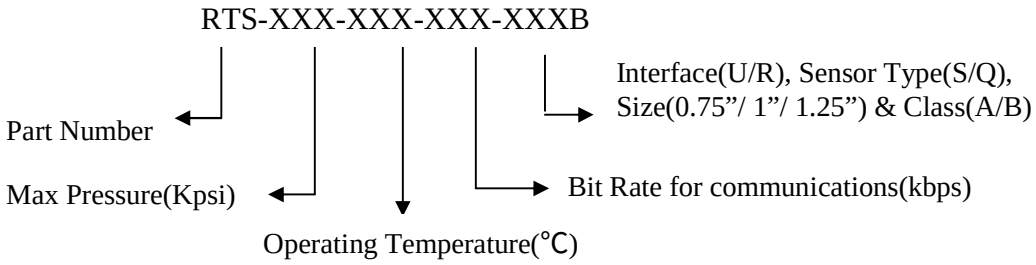
RTS-06K-150C-0.5M-RS075A (6000psi, 150℃, 0.5M samples/ RS232/ Silicon/0.75”/ class A)

RTS-20K-175C-1.0M-UQ100A (20000psi, 175℃, 1.0M samples/ USB/ Quartz/1.00”/ class A)

2.3 RTS class B (Surface read out) pressure gauge specifications

Sensor Type	Silicon-Sapphire or Quartz	
Pressure	Range:	Up to 20000 PSI
	Accuracy	0.03%(FS)
	Resolution	0.0003%
	Over capacity	110%(FS)
	Drift	3psi/year
Temperature	Atmosphere	150℃ (Max)
		175℃ (Max)
		185℃ - 200℃ (Max)
	Accuracy	0.5℃
	Resolution	0.01℃
	Over capacity	105%(FS)
Data format	Time/pressure/temperature/Date	
Sample rate	3 seconds to 6 hours (configurable, set on surface)	
Working mode	SRO (surface read out)	
Power	12V DC	
Communications	Interface	Both USB and RS232
	Bit rate (real-time)	1.0 -- 10 kbps
User Interface	Friendly user GUI software for gauge configuration, job upload and data view/plot/analysis, run on PC with Window2000/XP/Vista.	
Size	Outside diameter	1”, 1.25”
	Length	6”
Environment	H_2S	
Housing material	Inconel718-NACE, SS17-4 PH	

2.4 Ordering information



Example:

RTS-10K-175C-1.5K-RS100B (10000psi, 175℃, 1.5Kbps/ RS232/ Silicon/1.0”/ class B)

RTS-20K-185C-10K-UQ125B (20000psi, 185℃, 10Kbps/ USB/ Quartz/1.25”/ class B)

3. Installation and Operating Instructions

3.1 Assembly and configure the gauge

1. Install the O-rings

Make sure the O-rings and threads on the gauge are properly **lubricated** before installation.

Figure 1: The O-ring installation

2. Connect the lithium battery

Line up the red dot on the lithium battery with the red dot on the gauge and insert carefully. If this does not happen gently, double check to make sure the red dots are line up. The gauge starts to work immediately after the battery pack is connected. The gauge will goes to log data and put data into the flash memory after 10 minutes if the user does not /or forget to configure the gauge.

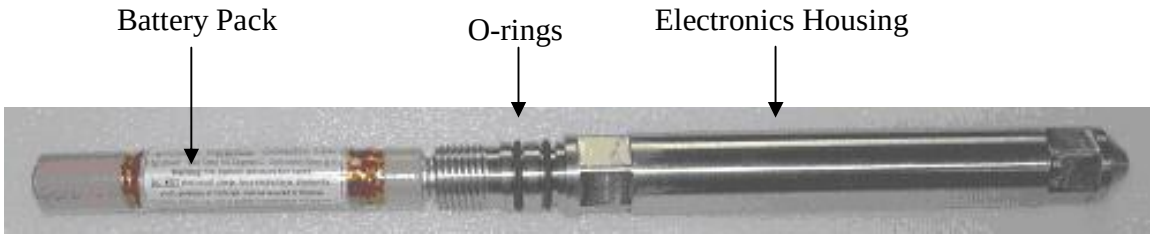


Figure 2: Connect the battery pack

3. Connect the download adapter

Line up the red dot on the download adapter with the red dot on the lithium battery and insert carefully. If this does not happen gently, double check to make sure the red dots are line up. Connect the download adapter and the PC computer with a USB cable (type B connector on the download adapter side and type A connector on the PC side).

Figure 3: The download adaptor

4. Configure the gauge

1) Start the RubyTek user software and switch to the battery page if the user software finds the gauge. Otherwise, It will exit if the software can't find a gauge. Below is the battery page.

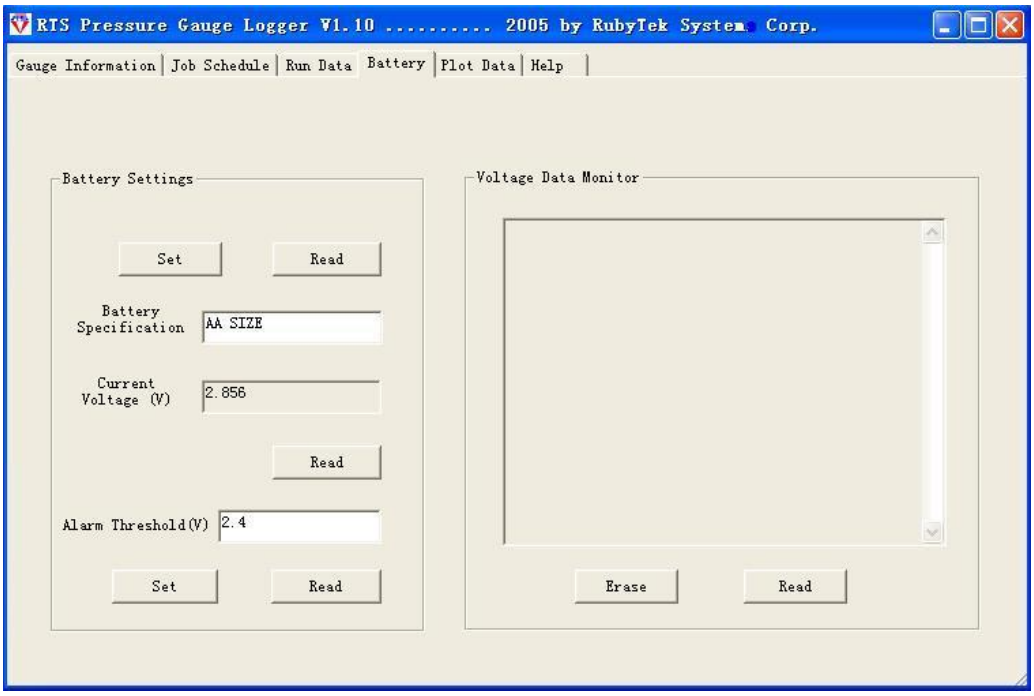


Figure 4: The battery page

Battery pack information such as the serial number can be filled into Battery Specification box and download into the gauge. The battery voltage can be measured by click the Current Voltage button.

Any standard 150℃—185℃ single AA lithium pack should have a voltage from 3.6-3.9V (refer to manufacturer data sheet) when new. The gauge will start to record samples with voltages less than Alarm threshold. A lithium battery with a starting voltage under manufacture specification should not be used. If a new battery shows a voltage less than expected, it may have a passivity layer problem. It is unknown what type of environmental changes the gauge experienced while it is down the well. Extreme temperature changes will definitely shorten the lifespan of the battery. Therefore it is suggested that a new battery be used each time the gauge is run into the well.

2) Configure the job schedule.

User can set sample interval and job hours for this interval, the maximum number for interval settings reaches up to 32. The software can estimate how many hours/days of this schedule. This schedule will store into flash after you click the download button (see **Figure 5**).

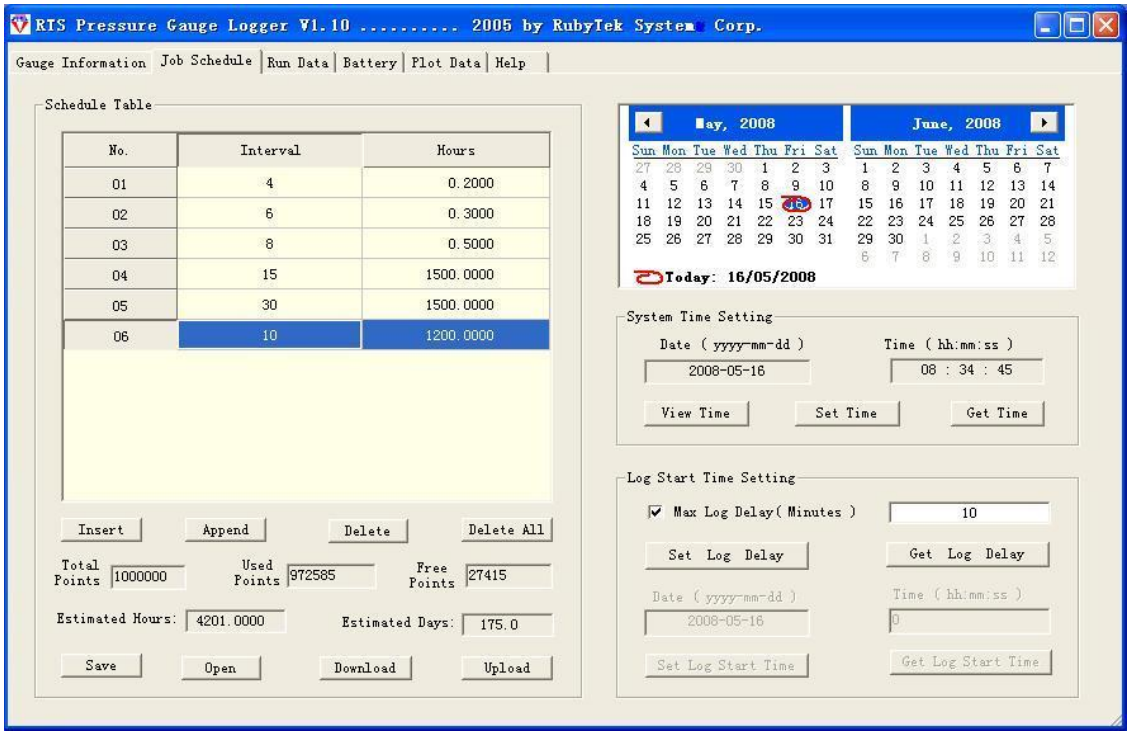


Figure 5: The job schedule page

3) Set system time.

The computer's system time will download into the gauge in the job schedule page after you click the **View Time** button and then the **Set Time** button. You can check the gauge time by clicking **Get Time** button.

4) Set log start time

There are two ways to set the gauge log start time. One is set the delay time relate to the gauge time. The default value is 10 minutes after the gauge powers on. Another is to set exact time (year/month/date, hour/minute/second), the gauge will record the samples after the time out.

5) Fill some user comment

Go to the gauge information page, some information can be filled into user comment box and this information can be downloaded into the gauge after the **Write Comments** button clicked.

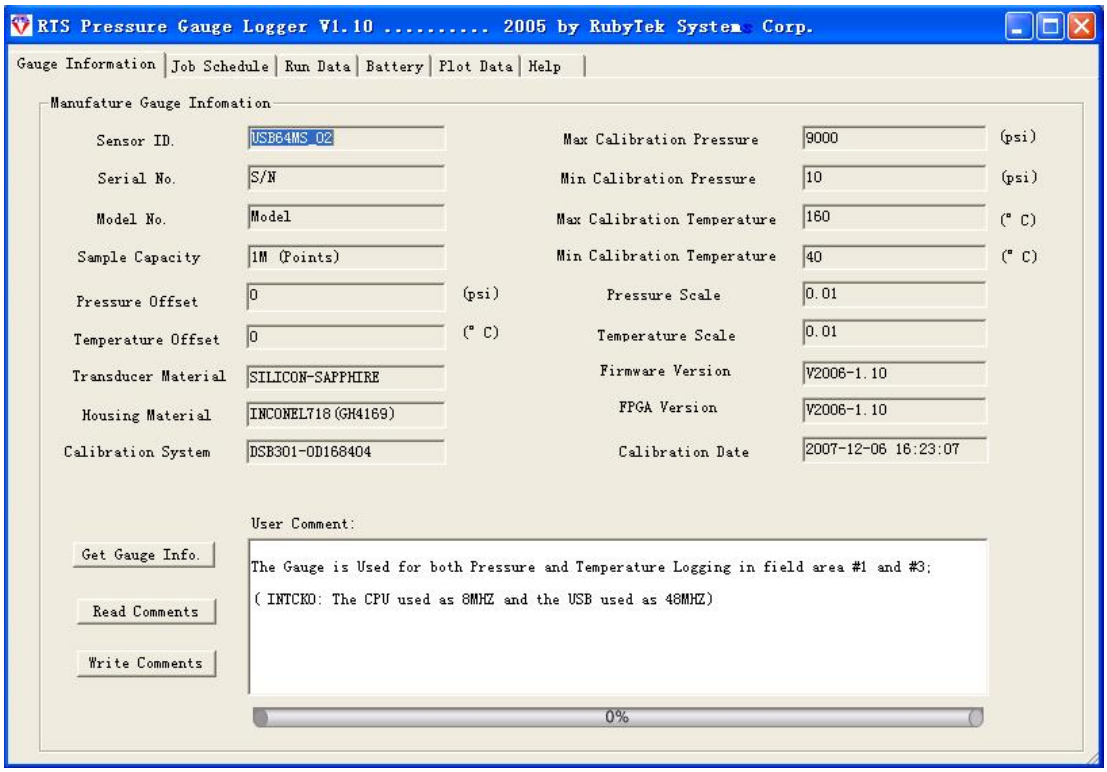


Figure 6: The gauge information page

5. Remove the download adapter.

One hand holds the battery and another hand pull out the download adapter carefully from the battery pack. Push the battery pack toward the electronics housing slightly to guarantee fasten connection between the gauge and the battery pack.

6. Install the battery housing

Slide the battery housing over the battery and tighten it onto the electronics housing. If this process is not easily done, stop. Remove the housing and the battery. Try sliding the battery into the housing by hand to see if there is any obstruction. If there is a problem, check to see if the inside of the housing is clear and check the outside of the battery for foreign material or swelling. The battery will twist off inside of the electronic housing socket if it does not fit freely in the battery housing.

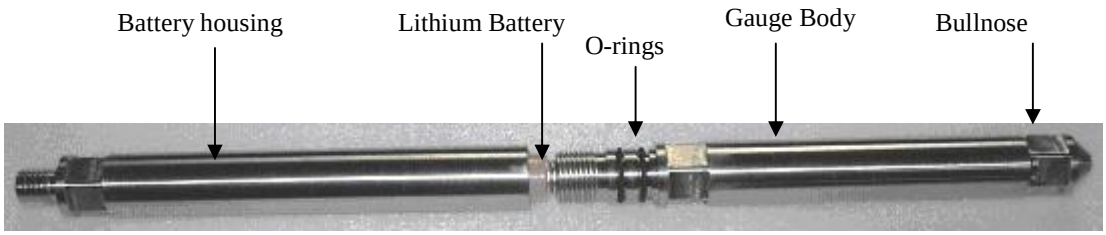


Figure 7: The battery housing installation

Tighten the battery housing on to the electronic housing using 5/8" or 17mm wrenches on the wrench flats. These gauges are O-ring sealed (not metal to metal sealed) and therefore should only be slightly more than hand-tight.

**** Do not over-tighten and do not use pipe wrenches on these gauges as you could damage the housing.***

7. The gauge is now ready to be run into a well.

3.2 After removal of the gauge

1. The gauge should be allowed the cool sufficiently before working with it.

2. Loosen the battery housing from the electronics housing using a 5/8" or 17mm wrench.

3. Slowly remove the battery housing from the electronics housing. Ensure no pressure has built up inside housing. Lift the battery housing off of the battery.

4. Remove the battery pack from the electronics housing socket by gripping the battery as close to the pin as possible and pull straight off the electronics housing. ***Do not twist the battery!!** It is now time to start downloading the information recorded by the gauge.

3.3 Upload the samples

1. Line up the red dot on the download adapter with the red dot on the gauge and insert carefully. They will only connect this way. **Do not force or twist!!** If the connection is difficult, stop and look to see what the obstruction might be. Clear all obstructions and try the connection again. Connect another side of the cable of download adapter to a PC computer's USB port.

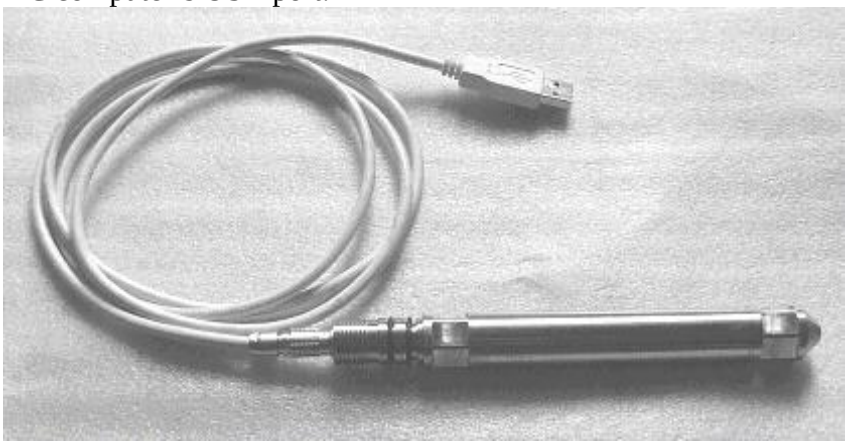


Figure 8: Cable connection for data upload

2. Start the RubyTek user software and switch to the run data page and upload the jobs recorded in the gauge. If the log start time didn't set before, it could be updated here during job upload. Please read the help manual of the RubyTek logger software for more detail.

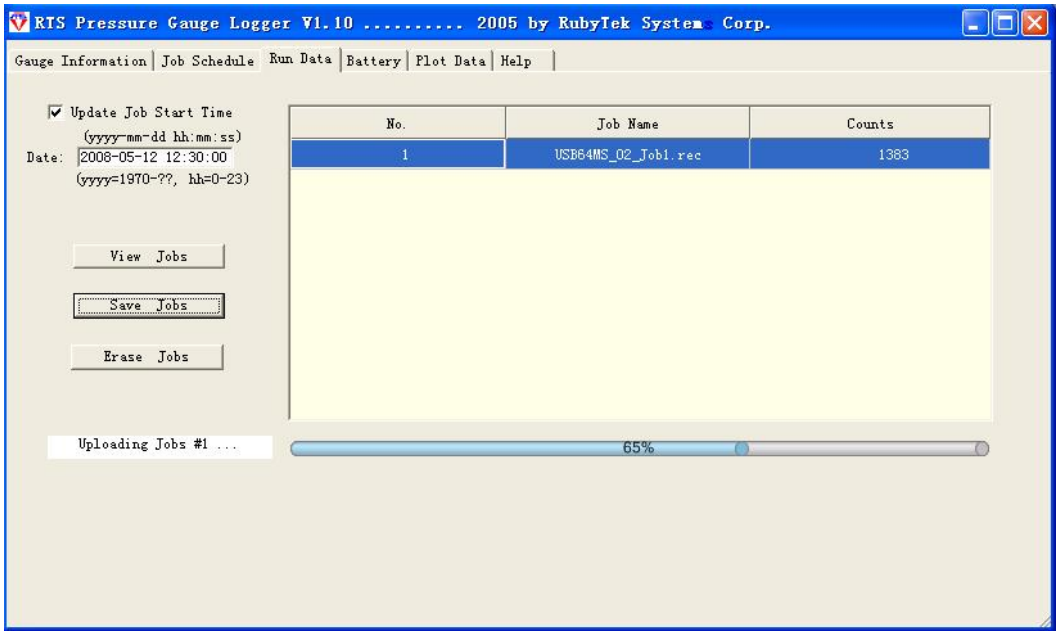


Figure 9: The run data page

3.4 Plot and analyze the data

1. Plot and compare the job data

After uploaded, the job can be opened and plotted in the plot data page for further analysis. Two jobs can be opened and plotted (with the **Draw1**, **Draw2** button) at the same time for comparison. Statistic information (maximum pressure and temperature, mean pressure value, etc.) inside the current viewing window and the values at current cursor can also be displayed for reference (see **Figure 10**). Please read the help manual of the RubyTek logger software for the detail.

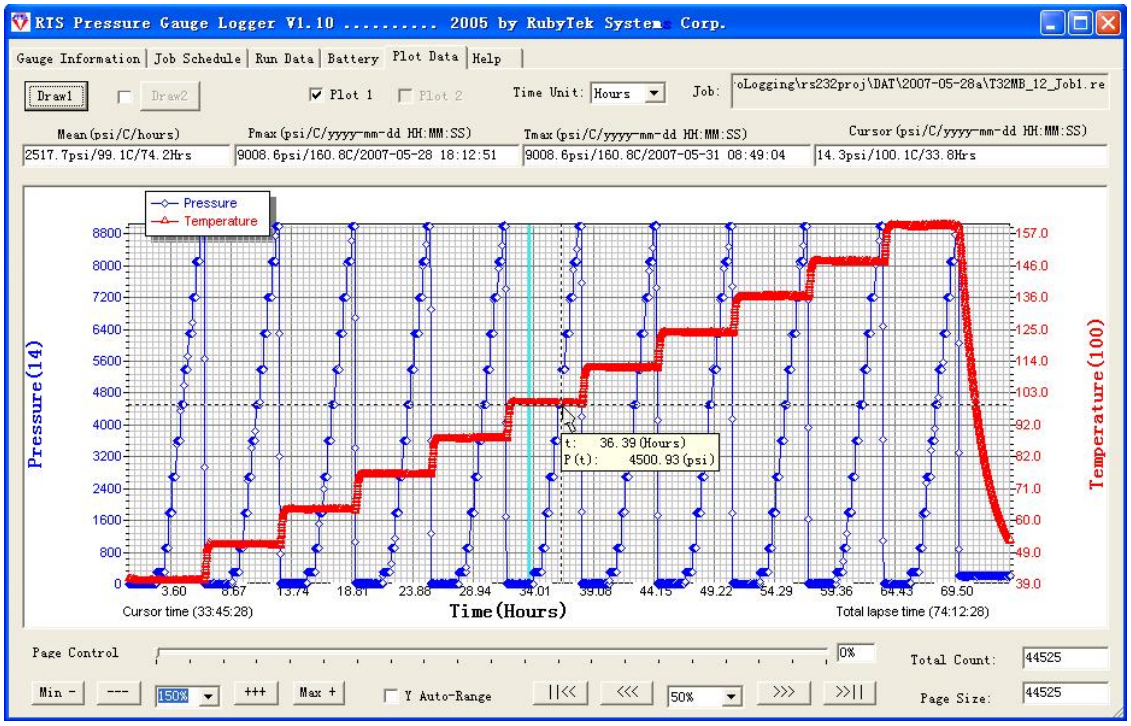


Figure 10: The plot data page

2. Analyze the job details by "Zoom In/Out" and "Message Tip"

After opened, in order to analyze the details of the data, the plot can be zoom in with "+++" or zoom out with the "---" button, and can be scrolled by tracking the scrollbar, or forward with ">>>" and backward with "<<<" button. The zoom feature can also be finished with mouse by a "**left button down & drag to select area**" action, i.e., drag from top-left to bottom-right is the zoom in, and drag from bottom-right to top-left is the zoom out (see **Figure 11**).

By moving the mouse cursor closely to a data point on the plot, the user can easily to view its detail values as a "message tip" on the selected point (see **Figure 12**).

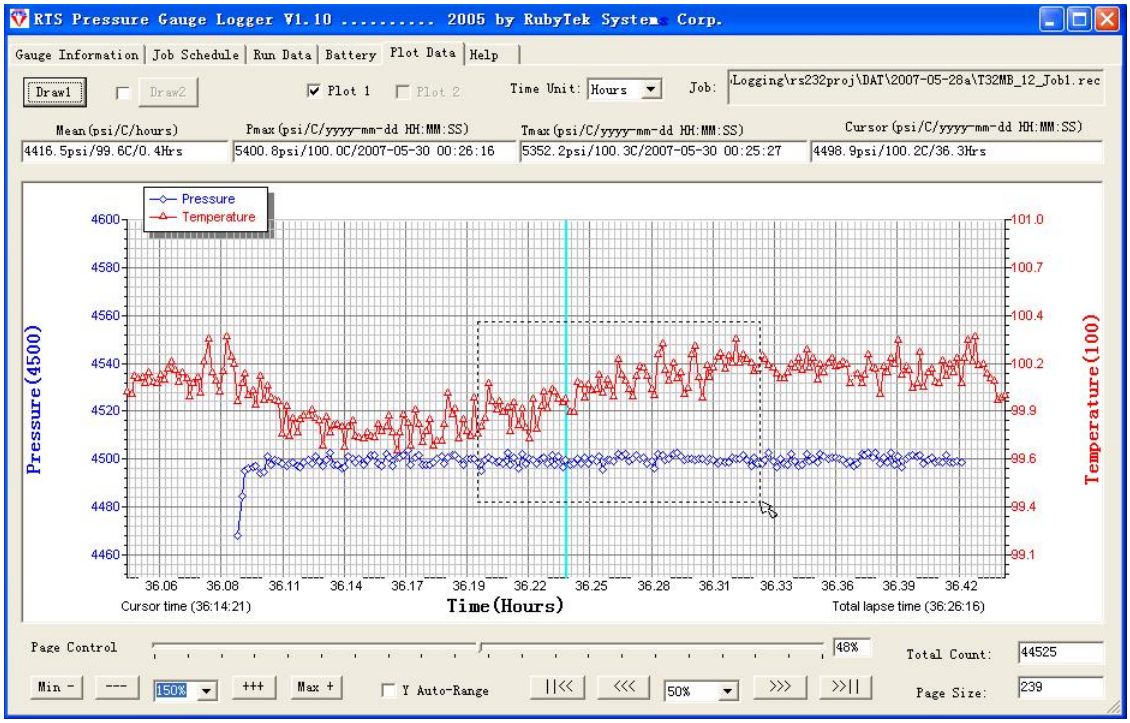


Figure 11: Select an area to zoom in for more detail

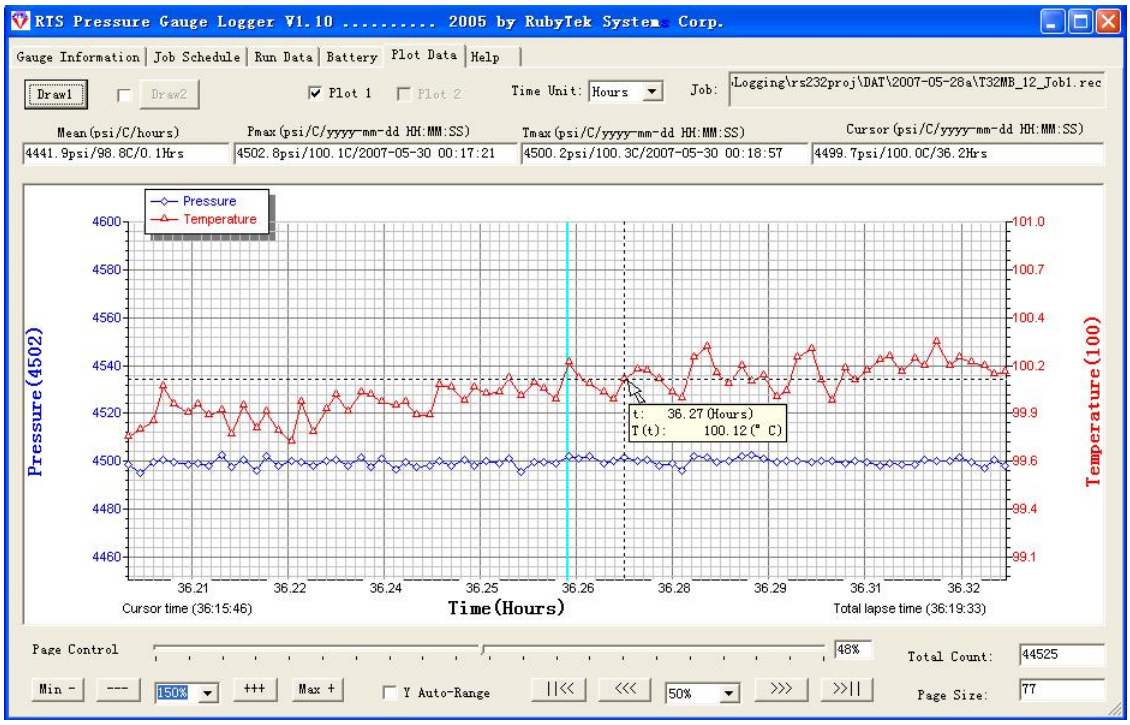
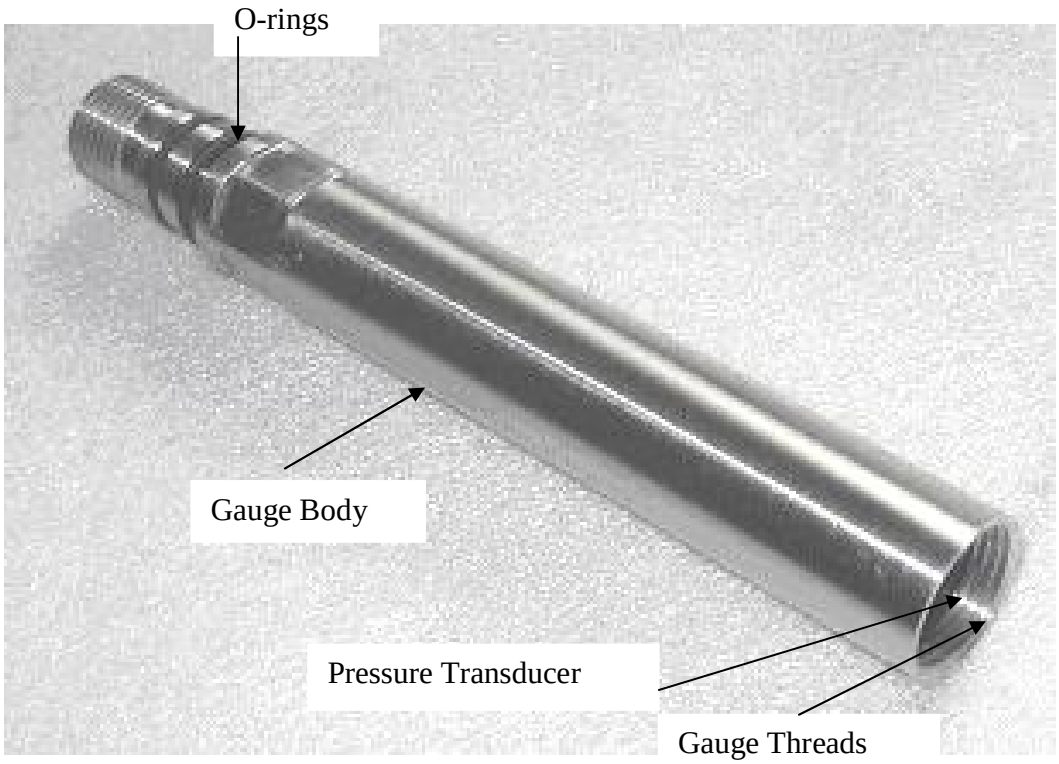


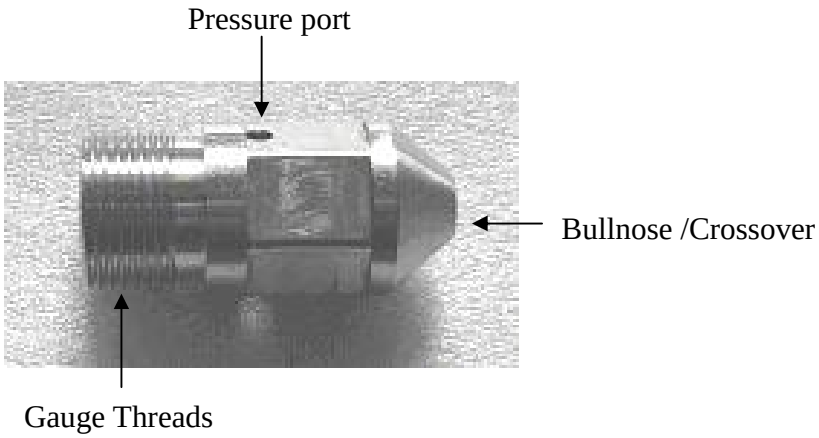
Figure 12: Zoom in/out and message tip for data analysis

3.5 Servicing of the gauge

1. After all data is uploaded from the gauge, carefully disconnect all components.

2. Clean and lubricate the gauge after use. Replace all O-rings after every run to protect the gauge from potential damage caused by failure. There are only two O-rings on the gauge at the top section of the electronics housing. Standard O-rings are number 014-V90 that supplied with the tools. O-rings should be selected based on the environment the tool will be run in.





3. Cleaning the transducer

Remove the bullnose or crossover after every run and clean the pressure ports. If the pressure ports get plugged, then the gauge may not read accurately. With the bullnose or crossover adapter off, carefully rinse the pressure transducer without directly touching it.

CAUTION: DO NOT TOUCH THE PRESSURE TRANSDUCER DIRECTLY AS IT CAN BE DEMAGED VERY EASILY. WHEN THE TOOL IS NOT BEING SERVICED, ENSURE THE BULLNOSE IS INSTALLED ON THE GAUGE TO PROTECT THE TRANSDUCER.

4. Lubricating the Gauge Threads

The threads on the top of the electronics housing and on the bullnose should be lubricated with the proper lubricant, such as Dow Corning 55-O-ring lubricant. This should be done prior to usage.

a) It should be noted that the gauge does contain electronics and should be treated gently whenever possible. Store gauges in their storage cases when not in use.

b) Never submerse the tool in fluid unless it is completely assembled.

c) If you are running a slick line test, do no exceed 150 feet per minute when running the gauges into and out of the hole.

4. Troubleshooting